



Regenerative Medicine in Dermatology

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Dear Editor,

Regenerative medicine is a developing field of medicine that has been used in both labs and clinics with the main aim of healing damaged parts through repairing, replacing, and regenerating the cell of the body (1, 2). Regenerative medicine, including soluble molecules (proteins, cytokines, growth factors), biomaterials (biomaterials are natural or synthetic substances used for the creation of skin substitutes in clinical applications), tissue engineering (in dermatology, numerous studies in the field of tissue engineering have been translated already into therapeutical applications, like for the treatment of chronic wounds), gene therapy (gene therapy approach is perfectly eligible for the treatment of diseases involving recessive loss-of-function mutations, as it occurs in junctional or recessive dystrophic epidermolysis bullosa (EB)), cell therapy (bone marrow and adipose mesenchymal stem cells present further suitable candidates for cell therapy) and cell reprogramming (induced pluripotent stem cells (iPS) were phenotypically and functionally indistinguishable from embryonic stem cells). Because of its easy accessibility, skin is becoming an attractive organ, and as the largest organ of the body, it is one of the most marked fields to step through (2). While there are many common acquired and inherited cutaneous pathologies, such as burns, diabetic ulcers, psoriasis, and vitiligo, which mostly are not well-treated and there is no gold standard treatment for them, regenerative medicine impresses as a novel and promising choice of treatment, both as monotherapy and combination therapy with

other operative therapeutics in dermatology (3, 4). Over the last two decades, fundamental advances have been made using scaffolds and cell types in this fast-growing area (5).

Mesenchymal stem cells (MSCs) are adult stem cells, which can be isolated from human sources (such as the dermis, adipose, and hypodermis). MSCs are mesodermal in origin and have the capacity to differentiate into different cells (6). MSCs have been greatly studied and can migrate towards injured areas in response to inflammation, differentiating into cells, like fibroblasts, adipose tissue, bone, and other mesenchymal lineages and then secreting pro-regenerative cytokines, chemokines, and growth factors (6). Therefore, MSCs have become the most promising therapeutic options for wound healing, increasing angiogenesis, and cancer (6). Adipose stem cells (ASCs) are among the best choices in wound healing procedures and many other purposes, like skin rejuvenile and skin remodeling, because of their capability of differentiating in various cells, promoting angiogenesis, and secreting numerous cytokines (7). Compared to the other stem cells harvested from the bone marrow, ASCs are higher in yields and more simply accessible (7).

Extracellular vesicles (EV), formerly called exosomes, are nano-sized vesicles containing specific nucleic acids, proteins, and lipids capable of cell-to-cell mediator transferring that has made them unique; hence, they can be utilized as a therapeutic and diagnostic tool in this field (8, 9). MSC-exosomes have shown anti-inflammatory, anti-aging, and wound healing properties and have been highly con-

sidered (8, 9).

Platelet-rich plasma (PRP) is plasma with a significant additional level of concentrated platelets that are obtained through centrifuging whole blood (10). Platelets are characterized by alpha granules containing a great load of growth factors and cytokines affecting homeostasis, tissue repairing, and collagen production (10, 11).

Stem cells-conditioned media (SCs-CM) or secretome contains several growth factors and cytokines; thus, it may be used as a better alternative to cell therapy, which needs to be elucidated. SCs-CM is where stem cells are cultured and secreted proteins, lipids, nucleic acids, and EVs (12). The interest in this method would be the potency of being produced in extensive quantities and preserved for a greater time without losing its efficacy (12, 13).

Regenerative medicine has been applied clinically in conditions, such as inflammatory and autoimmune diseases (e.g., systematic lupus erythematosus (14), and vitiligo (15)), scar healing (e.g., diabetic foot ulcer (16)), and cosmetic fields (e.g., skin resurfacing (17)).

Studies have revealed that PRP is an effective technique in treating vitiligo, and also it has a synergic effect with fractional CO₂ (15, 18). MSCs have been beneficial due to differentiating into keratinocytes, secreting numerous growth factors, and increasing the speed of wound closure (16).

Wang et al. have shown that MSCs, especially umbilical cord-derived stem cells, are associated with advantages in treating SLE (19). Studies have demonstrated that PRP, as an adjuvant to laser therapy and EVs, is so effective, especially on facial skin (20-24).

As mentioned above, regenerative medicine has shown promising results in dermatology. Given the rapidly developing nature of regenerative medicine, it will soon expand to other dermatology fields and transform treatment methods, leading to improvement in patients' health and quality of life.

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